DOCTORATE MOBILITY: GEOGRAPHIC ORIGINS AND DESTINATIONS OF DOCTORATE RECIPIENTS IN THE WEST

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This report addresses two questions related to state policy for and funding of doctoral study. First, to what extent do the western states, individually and as a regional grouping, provide access to doctoral-level education? Second, to what extent do the available doctoral-level programs provide each state and region with an adequate cadre of trained manpower?

An earlier report published by WICHE's Graduate Education Project (Kaufman and Krauth, 1979) detailed the growth in doctoral-level education in the West.* The report described the increasing numbers of institutions awarding the doctorate and the increasing number of degrees awarded in broad groupings of academic disciplines. Implicit in that report--as well as in this one--is the notion that doctoral-level education is a public good that benefits the student, state, region, and nation. While few individuals are likely to disagree with this assumption, many state policy makers react to graduate education's demands for scarce public funds by questioning its costs and benefits to their own states. The data presented here are necessary but not sufficient for assessing these costs and benefits.

The data presented in this report were provided by the National Research Council for the years 1967, 1972, and 1977. These points separate a period of growth, 1967-1972, from a period of relative stability, 1972-1977, in the numbers of doctorates awarded in the West.

Access to Doctoral Programs

Table 1 shows for each of three years (1967, 1972, and 1977) the number and percentage of doctoral recipients who graduated from high school in the same state their doctorates were awarded, another state in the West, or in a state outside the western region. To the extent that the state in which a student graduated from high school is an acceptable surrogate for residency, this table shows the access to doctoral programs provided by the western states for their own students. Identical data for each western state are included in Appendix A.

The data in table 1 are fairly consistent over time, showing that approximately 23 percent of the students receiving doctorates from universities in the West had graduated from high school in the same state. An additional 15 to 16 percent of the doctorate recipients had graduated from high school in another western state. The remaining 60 percent had

*This report uses the terms "the West" or "western region" to denote the thirteen states in the WICHE Compact: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

graduated outside the region. (This last figure also includes a small number of doctorate recipients whose place of high school graduation was unknown.)

Because the data in table 1 are weighted heavily by the numbers of doctorates awarded in California (over half the regional total), table 2 displays the same categories of data excluding California. With the California doctorates excluded, the percentage of students who received doctorates in the same state from which they graduated from high school decreased to approximately 15 or 16 percent for each year, while the regional figures rose to about 24 or 25 percent. These percentages are the reverse of the figures that include California, indicating, among other things, the attractiveness of California's universities. For the West as a whole, in each of the three years under study, approximately 40 percent of the doctorate recipients had also graduated from high school in the region. A much greater pattern of intraregional student migration emerges when the California figures are removed. The California data in Appendix A further reveal, over time, a steadily increasing proportion of doctorates who attended high school within the state, from 27 percent in 1967 to 30 percent in 1977.

Table 3 presents a measure of the net in-migration and out-migration of doctorate recipients in each of the nine census regions, which are defined in Appendix B. The numbers in table 3 represent what the National Research Council calls the "donor/receptor" ratios for each region at two educational levels: high school graduation and baccalaureate degree completion. The "donor/receptor" ratio is the number of doctorate bound (i.e., students who eventually earn the doctorate) high school or college graduates in each region divided by the number of doctorates granted in the region. These ratios are taken from the National Research Council publication, A Century of Doctorates (pp. 67-8), which explains, "One may think of this ratio as a 'donor/receptor' ratio, since all regions, 'give' students at one level to all other regions and 'receive' students from all regions for graduate education." If this giving and receiving are equal, the ratio is 1.00. A ratio greater than 1.00 indicates that a region contributes more doctorate-bound high school or college graduates than it receives. A ratio less than 1.00 indicates that a region awards more doctorates than its doctorate-bound high school or college graduates earn; hence, its "receptor" designation. Thus, these ratios ignore the actual in- and out-migration of students and base the ratios on total doctorate production and doctorates earned by indigenous students.

The Pacific region (Alaska, Washington, Oregon, California, and Hawaii) has been a "receptor" in all three time periods. That is, it awarded more doctorates in total over the fifteen-year period than were earned by high school graduates of the region over the same time span. In contrast, the Mountain region (Colorado, Montana, Wyoming, Utah, Idaho, Arizona, New Mexico, and Nevada) has evolved from a "donor" (i.e., more of its high school graduates earned Ph.D.s than the number awarded in the region) in the 1960-64 period to a "receptor" in the 1965-69 and 1970-74 periods. It was the only region in the country to shift from a "donor" to a "receptor," a measure that underscores the growth in the number of doctorates

awarded as well as the in-migration of doctoral students from outside the region. The 1965-69 half-decade marked the first time that institutions in the Mountain region awarded more doctorates than were earned by its residents. In addition, the reversal from donor to receptor was so dramatic that the "donor/receptor" ratio for the Mountain states became the lowest among the nine regions; that is, relatively, the Mountain region is the greatest net importer of doctoral students in the nation. The Pacific region is second. In contrast, the Middle Atlantic, West North Central, East South Central, and West South Central regions are net "donors" of Ph.D. recipients.

These figures shed no light on field-by-field differences in attracting students, but the aggregate figures presented in tables 1 and 2 and the "donor/receptor" ratios presented in table 3 reflect a nationwide influx of Ph.D. students to western universities. These figures attest to the perceived quality and popularity of western institutions as well as the national character of graduate education itself. The figures do not separate public from private institutions, although the Mountain states have very few nonpublic doctorate-granting institutions. However, when these figures are used as a very rough surrogate for educational opportunity, it is clear that the West, as a whole, provides more opportunity to earn a doctorate than is demanded by western residents alone.

Table 4 shows the geographic origins of students who earn their Ph.D.s in the Mountain and Pacific states. Using region of high school graduation as a surrogate for residency, the data in table 4 reveal that 26.3 percent of the doctorate recipients in the Mountain states also graduated from high school in that region. The corresponding figure for the Pacific states was 33.6 percent. In contrast, 49.5 percent of Middle Atlantic region Ph.D.s were graduates of high schools in the same region, as were 49.6 percent of West South Central region Ph.D.s The largest influx of Pacific Ph.D.s came from foreign countries, followed by the Middle Atlantic states, while the East and West North Central regions combined to provide 26.6 percent of Mountain region Ph.D.s. Appendix C presents these data for all regions in matrix form, allowing the reader to make comparisons. The vertical percentages in the matrix refer to the percentage distribution of regions sending students to each of the other regions.

Information on where doctorate-bound high school graduates in the Mountain and Pacific regions went for doctoral study is found in table 5. The data indicate that 55.8 percent of Pacific high school graduates in the period 1960-74 who subsequently went on to earn Ph.D.s did so at universities within the same region. This figure is the second highest in the nation, surpassed only by 0.1 percentage point in the East North Central states. In contrast, only 36.9 percent of Mountain states' high school graduates earning Ph.D.s attended universities in the region, among the lowest rates in the nation. The horizontal percentages in Appendix C allow the reader to compare the percentage of doctorate-bound high school graduates earning degrees in each of the nine census regions.

Several observations can be made from the data presented in tables 4 and 5 and in Appendix C: First, the market for doctoral study is clearly national. The vertical percentages in Appendix C show that fewer than half the doctorates awarded by institutions in any given region are earned by high school graduates of that region. In addition, the horizontal percentages reveal that in only three of nine cases did more than half of all doctorate-bound high school graduates earn their doctoral degrees at a university in the same region. Put another way, in six out of nine regions, a majority of doctorate-bound high school graduates went out of the region to earn the doctorate. In addition, institutions in most regions awarded a sizable proportion of their doctorates to foreign students. In terms of sheer numbers, the interdependencies among regions are manifest. Therefore, questions of providing opportunity and access for individuals cannot be answered by reference to state, or even regional, data alone.

Where Do Ph.D.s from Western Institutions Go?

The first part of this report presented information on the geographic origins of Ph.D.s, with special emphasis on where doctorate recipients of western universities come from. This section will deal with the question "Where do they go?" in state and regional terms. The answer to this question is often used to assess the implied economic returns to states and regions of their investment in doctoral-level education. To the extent that Ph.D. recipients remain in the same state or region after they graduate, doctoral-level education is thought to provide valuable regional resources in the form of highly skilled manpower. Obviously, the value to the region of doctorates in different fields varies, and regional retention of graduates is clearly related to career opportunities for individuals. Nevertheless, the notion of doctoral-level education as a public investment linked to regional manpower requirements continues to have strong support. However, the data presented here suggest that this approach may be too restrictive when focused on a single state, university, or discipline. This section presents aggregate data on the postgraduation destinations of doctorate recipients.

Table 6 shows the percentage distribution by region of the doctorate degrees awarded and the postgraduation destination of the doctorate recipients for the period 1960-74. During that period, the thirteen western states (the Mountain and Pacific regions) produced 19.3 percent of all doctorates awarded in the nation and served as the post-Ph.D. destination for 19.9 percent of all Ph.D.s. Thus, employment and postdoctoral research opportunities in the West were roughly in balance with the aggregate supply of Ph.D.s produced by western universities. The Mountain states were in an overall equilibrium position, producing 5.4 percent of the nation's doctorates and receiving 5.4 percent after graduation. The Pacific states produced 13.9 percent of all doctorates while becoming the home of 14.5 percent. Thus, even though the Pacific states were net importers of doctoral students, they did not award quite enough doctorates to fill the aggregate demand for Ph.D.s in the region. Although the West and several other regions gained a supply of highly educated individuals, the New England, East North Central, and West North Central regions suffered what, in another context, has been referred to as the "brain drain."

On the whole, the West received an influx of both students and educated manpower that are clearly attributable to both the recruitment practices of universities, which bring in a national clientele, and the economic opportunities available in the region. These conclusions are reinforced by the data in table 7, showing interregional movement after the degree for recipients of doctorates from western universities and their postgraduation activity. Appendix D contains the same information for all regions.

The data in table 7 reveal that, of the 81.3 percent of Pacific states' doctorate recipients who went into academic employment in the United States between 1960 and 1974, more than one-half (but 43.8 percent of the total including foreign students and unknowns) remained in the Pacific region, while an additional 6.5 percent went to colleges and universities in the Mountain states. An even greater percentage of Ph.D.s in both the Mountain and Pacific regions remained in the region for nonacademic employment than for academic employment, evidence, certainly, of a contribution toward the demand for highly trained manpower outside academe. While the data in table 7 and Appendix D illustrate the high degree of geographic mobility of doctorate recipients with respect to careers, they also illustrate the very important proportions of each region's doctorally educated manpower supplied by universities in that region.

Table 8 presents a state-by-state profile of the geographic destination of Ph.D.s from twelve of the thirteen western states for three years: 1967, 1972, and 1977. (Alaska is excluded.) These data allow the reader to view the changes in each western state's retention of its own doctorates over time. The numbers and percentages combine all postgraduation activities. California retained the greatest percentage of its doctorate recipients, but the 1977 figure of 34.9 percent is down from the 1967 mark of 39.0 percent. In contrast, Colorado, Arizona, and Utah retained a larger percentage of their doctorates in 1977 than 10 years earlier. Most of the western states saw a drop over time in the percentage of their doctorates who located in other western states.

Table 9 presents a somewhat clearer picture by eliminating the category of unknowns from the table and basing the percentages on the remaining number whose postgraduation destinations were known. Most of the states show an increase over time in their retention of Ph.D.s, while the percentages of doctorate recipients locating in other western states or elsewhere in the nation tended to decline. Eight states witnessed an increase in the proportions of doctorates going to foreign countries.

Conclusions

This report has addressed two policy issues concerning state support for doctoral-level education: the extent to which western states provide access to doctoral-level training and the extent to which that training provides each state and region with an adequate supply of highly trained manpower. The data presented here suggest the complexity of these issues; they also suggest that too narrow a focus on individual state interests is inappropriate. The benefits a state derives from an investment in

doctoral-level education are best determined by referring to many facets of the question, including the degree to which students migrate among states both to study for advanced degrees and after their graduations. Such a broadened perspective is useful to states in their analyses of existing and proposed doctoral programs.

Access

The question of access should not be examined solely in terms of the needs of a state's residents. As these data indicate, the state is too small a unit to consider. The migration of students within a region and even nationally suggests the weakness of the argument for a new program on the basis of a need to provide access to residents of a single state. Program planning which takes into account the resources available regionally will alleviate the sense that each state must offer a comprehensive array of doctoral programs.

On the other hand, the drawing power of western institutions is also clear from the data. Strong programs that enroll large numbers of out-of-state students should not be judged negatively on this measure alone, because quality programs will recruit and naturally draw qualified students from outside the state. Given the tendency of students to migrate in significant numbers to attend doctoral-level programs, perhaps the most useful way for states to view the question of access is as an opportunity to provide a somewhat limited number of quality programs that will draw students from a large region. Public policy could encourage state residents to seek programs in fields not offered in the state from those offered in the same region. Such a regional vision of doctoral program planning could be made more efficient by building on a base of institutional strengths and existing patterns of student migration.

Manpower Supply

From the point of view of the need for highly educated manpower, the data in this report also have important implications. For example, if a state decides to initiate a doctoral program in discipline x because of projected manpower shortages, it should be prepared to see some of its graduates leave the state after their training. By the same token, it should also expect to be able to draw on graduates of other states' doctoral programs, thus bringing into the state highly qualified individuals who contribute to the state's economy. Taken together, the data in this report make clear the regional, national, even international, character of doctoral-level education. Understanding this character, planners will be able to link program initiation and student recruitment strategies to broad forecasts of future needs and institutional resources rather than to immediate market demands for graduates within a particular state.

Keeping the Issues Separate

Although educational access and manpower supply are often seen as complementary goals, they need not be linked. That is, one can consider

the issue of access separately from the issue of manpower supply. For example, even though the goal of access to doctoral study for state residents is reached, existing programs may not yield the supply of manpower needed by the state because of the particular courses of study offered by universities and the fields selected by students. From this perspective, it would be perfectly reasonable for students to attend doctoral programs out-of-state and for Ph.D.s from other states to migrate to areas of available employment.

In addition, policy analysts should consider the educational, technical, and scientific outcomes that are often the products of doctoral programs. Ph.D.s are only one measure of outcomes. A doctoral program that attracts high-quality faculty members may provide the state and region with benefits that result from their research and public service.

The report underscores the complexity of questions frequently asked by state policy makers evaluating the costs and benefits of doctoral-level education. The implications for state policy of the data in the report related to both access and manpower are multi-faceted. They suggest above all, however, that these issues need to be viewed in a broad context and that educational quality should be the primary factor in decisions affecting state policy for graduate education.

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APPENDICES

Table 1

Doctorate Recipients in the West
by State of Their High School Graduation
1967, 1972, and 1977

	State of High School Graduation						
	Same State		Other Western		Outside Region		Total
	N	%	N	%	N	%	
1967	925	23	590	15	2504	62	4019
1972	1516	23	1092	17	3970	60	6578
1977	1474	23	954	15	3910	62	6338

SOURCE: Survey of Earned Doctorates, Commission on Human Resources, National Research Council.

Table 2

Doctorate Recipients in the West, Excluding California,
by State of Their High School Graduation
1967, 1972, and 1977

	State of High School Graduation						
	Same State		Other Western*		Outside Region		Total
	N	%	N	%	N	%	
1967	285	17	404	24	997	59	1686
1972	522	17	816	26	1822	58	3160
1977	437	15	727	25	1756	60	2920

*Includes California.

SOURCE: Survey of Earned Doctorates, Commission on Human Resources, National Research Council.

Table 3

Ratio of Doctorate-Bound High School Graduates
and Baccalaureates to Doctorates Awarded
in Each Region

Region	High School to Ph.D.			Baccalaureate to Ph.D.		
	1960-1964	1965-1969	1970-1974	1960-1964	1965-1969	1970-1974
New England	0.77	0.82	0.88	1.01	1.13	1.15
Middle Atlantic	1.26	1.37	1.43	1.06	1.15	1.18
East North Central	0.81	0.87	0.86	0.84	0.89	0.89
West North Central	1.23	1.26	1.21	1.21	1.25	1.21
South Atlantic	0.93	0.84	0.84	0.93	0.84	0.84
East South Central	1.60	1.31	1.18	1.63	1.29	1.20
West South Central	1.21	1.12	1.05	1.22	1.11	1.05
Mountain	1.14	0.84	0.74	1.25	0.90	0.81
Pacific	0.76	0.74	0.83	0.81	0.79	0.89

SOURCE: National Research Council, A Century of Doctorates, 1978.

Table 4

Mountain or Pacific States Ph.D.s
Who Were Graduated from High School
in Each of Nine Census Regions, 1960-1974

Mountain States Ph.D.s (%)	(FROM) Region of High School Graduation	Pacific States Ph.D.s (%)
2.8	New England	3.6
8.4	Middle Atlantic	10.1
13.0	East North Central	9.9
13.6	West North Central	6.1
3.1	South Atlantic	3.2
1.5	East South Central	1.1
6.1	West South Central	3.0
26.3	Mountain	5.8
11.9	Pacific	33.6
11.4	Foreign	19.8
1.8	Unknown	3.8
100.0%	Total	100.0%

SOURCE: National Research Council, A Century of Doctorates, 1978.

Table 5

Regions Where High School Graduates
of the Mountain and Pacific States
Earned Ph.D.s, 1960-1974

Mountain States High School Graduates (%)	(TO) Region of Ph.D.	Pacific States High School Graduates (%)
4.0	New England	5.6
6.0	Middle Atlantic	7.4
14.8	East North Central	12.2
7.6	West North Central	4.2
4.3	South Atlantic	3.9
1.0	East South Central	0.7
4.7	West South Central	2.4
36.9	Mountain	7.7
20.8	Pacific	55.8
100.1%*	Total	100.2%*
(12,937)		(28,103)

SOURCE: National Research Council, A Century of Doctorates, 1978.

*Percentages do not sum to 100 due to rounding error.

Table 6

Percentage Distribution of Degrees Granted and Postgraduation Location

Region	Ph.D.	Post-Ph.D.
New England	8.8	7.9
Middle Atlantic	18.7	18.8
East North Central	23.6	18.3
West North Central	8.5	7.6
South Atlantic	10.9	15.1
East South Central	3.2	4.7
West South Central	7.0	7.6
Mountain	5.4	5.4
Pacific	13.9	14.5
TOTAL	100.0	100.0

SOURCE: Survey of Earned Doctorates, Commission on Human Resources, National Research Council.

Table 7

Regional Interchanges After the Doctorate:
Percentage Distributions by Region of Destination and Employment
1960-1974

Region of Ph.D.	Region of Post-Ph.D. Destination: New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	U.S. Total	Foreign	Unknown
Mountain												
Postdoctoral study	4.9	8.1	9.5	4.1	8.0	1.1	3.7	24.6	11.5	75.4	10.8	13.8
Academic employment	1.6	3.5	9.5	10.3	4.4	2.1	6.1	29.1	12.3	78.8	4.3	16.9
Nonacademic employment	0.9	3.8	4.7	4.2	4.4	0.7	3.7	34.7	12.5	69.6	7.6	22.8
Pacific												
Postdoctoral study	7.0	8.2	6.8	2.0	5.5	0.5	1.7	2.4	40.2	74.4	16.4	9.2
Academic employment	3.9	6.4	8.6	4.0	4.1	1.1	2.8	6.5	43.8	81.3	7.2	11.5
Nonacademic employment	1.4	5.5	2.6	1.0	4.7	0.4	1.2	2.5	47.7	67.0	15.0	18.0

SOURCE: National Research Council, A Century of Doctorates, 1978.

Table 8

Postgraduation Locations of Doctorate Recipients From Western Universities by State, 1967, 1972, and 1977

State of Doctorate	Location After Receiving Doctorate: Same State N (%)	Other WICHE N (%)	Other U.S. N (%)	Foreign N (%)	Unknown N (%)	Total N
Alaska - No data available						
Arizona						
1967	43 (18.3)	56 (23.8)	71 (30.2)	8 (3.4)	57 (24.2)	235
1972	106 (27.7)	60 (15.7)	111 (29.0)	23 (6.0)	83 (21.7)	383
1977	106 (25.5)	80 (19.3)	92 (22.2)	26 (6.3)	111 (26.7)	415
California						
1967	910 (39.0)	167 (7.2)	637 (27.3)	241 (10.3)	378 (16.2)	2333
1972	1295 (37.9)	187 (5.5)	682 (20.0)	391 (11.4)	763 (22.3)	3418
1977	1193 (34.9)	155 (4.5)	721 (21.1)	307 (9.0)	1042 (30.5)	3418
Colorado						
1967	78 (20.6)	61 (16.1)	218 (57.8)	28 (7.4)	51 (13.5)	378
1972	159 (22.6)	91 (12.9)	263 (37.3)	63 (8.9)	129 (18.3)	705
1977	192 (27.3)	99 (14.1)	170 (24.2)	53 (7.5)	189 (26.9)	703
Hawaii						
1967	5 (17.8)	6 (21.4)	6 (21.4)	5 (17.8)	6 (21.4)	28
1972	21 (26.2)	9 (11.2)	11 (13.8)	15 (18.8)	24 (30.0)	80
1977	27 (20.0)	9 (6.7)	19 (14.1)	31 (23.0)	49 (36.3)	135
Idaho						
1967	0 (0.0)	9 (60.0)	3 (20.0)	0 (0.0)	3 (20.0)	15
1972	12 (20.7)	16 (27.6)	10 (17.2)	2 (3.4)	18 (31.0)	58
1977	3 (6.1)	8 (16.3)	15 (30.6)	5 (10.2)	18 (36.7)	49
Montana						
1967	9 (18.4)	9 (18.4)	22 (44.9)	2 (4.1)	7 (14.3)	49
1972	11 (15.7)	13 (18.6)	20 (28.6)	5 (7.1)	21 (30.0)	70
1977	16 (25.4)	9 (14.3)	18 (28.6)	8 (12.7)	12 (19.0)	63
Nevada						
1967	0 (0.0)	2 (33.3)	2 (33.3)	1 (16.7)	1 (16.7)	6
1972	3 (14.3)	6 (28.6)	4 (19.0)	1 (4.7)	7 (33.3)	21
1977	10 (30.3)	8 (24.2)	5 (15.2)	1 (3.0)	9 (27.3)	33
New Mexico						
1967	25 (29.8)	15 (17.8)	23 (27.4)	4 (4.8)	17 (20.2)	84
1972	53 (28.2)	21 (11.2)	58 (30.8)	7 (3.7)	49 (26.1)	188
1977	43 (26.4)	12 (7.4)	46 (28.2)	4 (2.4)	58 (35.6)	163
Oregon						
1967	58 (21.6)	70 (26.0)	82 (30.5)	27 (10.0)	32 (11.9)	269
1972	116 (21.1)	138 (25.1)	119 (21.7)	73 (13.3)	103 (18.8)	549
1977	68 (16.7)	69 (17.0)	83 (20.4)	58 (14.2)	129 (31.7)	407
Utah						
1967	46 (21.1)	46 (21.1)	59 (27.1)	18 (8.2)	49 (22.5)	218
1972	120 (24.6)	112 (23.0)	117 (24.0)	24 (4.9)	114 (23.4)	487
1977	120 (28.1)	84 (19.7)	95 (22.2)	19 (4.4)	109 (25.5)	427
Washington						
1967	81 (22.6)	76 (21.2)	105 (29.2)	35 (9.7)	62 (17.3)	359
1972	134 (24.8)	88 (16.3)	157 (29.0)	55 (10.2)	107 (19.8)	541
1977	105 (22.7)	82 (17.7)	107 (23.2)	34 (7.4)	134 (29.0)	462
Wyoming						
1967	8 (17.8)	11 (24.4)	16 (35.6)	1 (2.2)	9 (20.0)	45
1972	14 (17.9)	18 (23.1)	21 (26.9)	5 (6.4)	20 (25.6)	78
1977	10 (15.9)	19 (30.2)	18 (28.6)	3 (4.8)	13 (20.6)	63

SOURCE: Survey of Earned Doctorates, Commission on Human Resources, National Research Council.

Table 9

Percentage Distribution of Postgraduation Locations of Doctorate Recipients from Western Universities, by State, 1967, 1972, and 1977 (Excluding Unknowns)

State of Doctorate	Same State %	Other WICHE %	Other U.S. %	Foreign %
Alaska - No data available				
Arizona				
1967	24.2	31.5	39.9	4.5
1972	35.3	20.0	37.0	7.7
1977	34.9	26.3	30.3	8.6
California				
1967	46.5	8.5	32.6	12.3
1972	48.8	7.0	25.7	14.7
1977	50.2	6.5	30.3	12.9
Colorado				
1967	23.9	18.7	66.7	8.6
1972	27.6	15.8	45.7	10.9
1977	37.4	19.3	33.1	10.3
Hawaii				
1967	22.7	27.3	27.3	22.7
1972	37.5	16.1	19.6	26.8
1977	31.4	10.5	22.1	36.0
Idaho				
1967	0.0	75.0	25.0	0.0
1972	30.0	40.0	25.0	5.0
1977	9.7	25.8	48.4	16.1
Montana				
1967	21.4	21.4	52.4	4.8
1972	22.4	26.5	40.8	10.2
1977	31.4	17.6	35.3	15.7
Nevada				
1967	0.0	40.0	40.0	20.0
1972	21.4	42.8	28.6	7.1
1977	41.7	33.3	20.8	4.2
New Mexico				
1967	37.3	22.4	34.3	6.0
1972	38.1	15.1	41.7	5.0
1977	41.0	11.4	43.8	3.8
Oregon				
1967	24.5	29.5	34.6	11.4
1972	26.0	30.9	26.7	16.4
1977	24.5	24.8	29.9	20.9
Utah				
1967	27.2	27.2	34.9	10.7
1972	32.2	30.0	31.4	6.4
1977	37.7	26.4	29.9	6.0
Washington				
1967	27.3	25.6	35.4	11.8
1972	30.9	20.3	36.2	12.7
1977	32.0	25.0	32.6	10.4
Wyoming				
1967	22.2	30.6	44.4	2.8
1972	24.2	31.0	36.2	8.6
1977	20.0	38.0	36.0	6.0

SOURCE: Survey of Earned Doctorates, Commission on Human Resources, National Research Council

APPENDIX A

Doctorate Recipients from Each Western State by State of Birth, High School Graduation, and Baccalaureate Degree, 1967, 1972, and 1977

FISCAL YEAR OF DOCTORATE		STATE OF BACCALAUREATE SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL	STATE OF HIGH SCHOOL SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL	STATE OF BIRTH SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL
STATE OF DOCTORATE - ARIZONA													
1967	N	37	58	140	235	25	58	152	235	10	52	173	235
1972	N	73	103	207	383	46	99	238	383	21	87	275	383
1977	N	68	116	231	415	46	113	256	415	23	88	304	415
STATE OF DOCTORATE - CALIFORNIA													
1967	N	798	177	1358	2333	640	186	1507	2333	414	208	1711	2333
1972	N	1210	258	1950	3418	994	276	2148	3418	671	266	2481	3418
1977	N	1313	209	1896	3418	1038	227	2154	3418	696	212	2510	3418
STATE OF DOCTORATE - COLORADO													
1967	N	62	55	261	378	44	57	277	378	33	48	297	378
1972	N	128	116	461	705	91	114	500	705	52	97	556	705
1977	N	140	125	438	703	101	106	496	703	68	88	547	703
STATE OF DOCTORATE - HAWAII													
1967	N	3	4	21	28	2	2	24	28	2	2	24	28
1972	N	8	16	56	80	6	12	62	80	6	8	66	80
1977	N	14	27	92	135	14	19	102	135	14	15	106	135
STATE OF DOCTORATE - IDAHO													
1967	N	6	4	5	15	4	4	7	15	4	5	6	15
1972	N	6	23	29	58	4	24	30	58	4	19	35	58
1977	N	3	12	34	49	1	11	37	49	1	6	42	49

STATE OF DOCTORATE - MONTANA

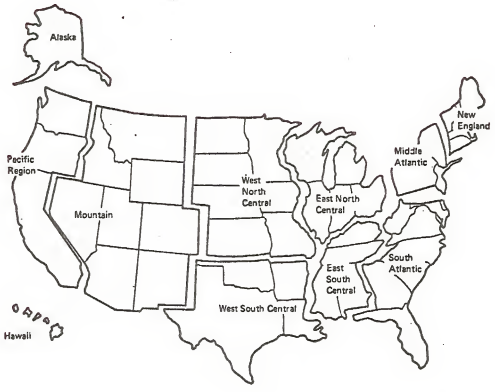
FISCAL YEAR OF DOCTORATE		STATE OF BACCALAUREATE: SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL	STATE OF HIGH SCHOOL: SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL	STATE OF BIRTH: SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL
1967	N	11	12	26	49	8	12	29	49	7	10	32	49
1972	N	10	24	36	70	10	19	41	70	9	18	43	70
1977	N	13	14	36	63	14	14	35	63	10	12	41	63
STATE OF DOCTORATE - NEVADA													
1967	N		5	1	6		5	1	6		2	4	6
1972	N		10	11	21		9	12	21		6	15	21
1977	N	4	17	12	33	3	15	15	33	2	10	21	33
STATE OF DOCTORATE - NEW MEXICO													
1967	N	14	13	57	84	9	11	64	84	6	10	68	84
1972	N	44	35	109	188	38	29	121	188	21	26	141	188
1977	N	30	36	97	163	22	33	108	163	13	26	124	163
STATE OF DOCTORATE - OREGON													
1967	N	47	109	113	269	31	98	140	269	27	76	166	269
1972	N	101	219	229	549	73	209	267	549	48	180	321	549
1977	N	64	146	197	407	45	140	222	407	32	106	269	407
STATE OF DOCTORATE - UTAH													
1967	N	110	28	80	218	78	48	92	218	77	39	102	218
1972	N	197	125	165	487	141	152	194	487	137	121	229	487
1977	N	176	109	142	427	96	138	193	427	107	124	196	427

STATE OF DOCTORATE - WASHINGTON

FISCAL YEAR OF DOCTORATE		STATE OF BACCALAUREATE SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL	STATE OF HIGH SCHOOL SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL	STATE OF BIRTH SAME STATE	OTHER WICHE	OTHER /UNKN	TOTAL
1967	N	102	91	166	359	79	96	184	359	53	91	215	359
1972	N	130	150	261	541	105	134	302	541	71	126	344	541
1977	N	107	141	214	462	87	125	250	462	62	109	291	462
STATE OF DOCTORATE - WYOMING													
1967	N	6	14	25	45	5	13	27	45	5	12	28	45
1972	N	8	15	55	78	8	15	55	78	6	11	61	78
1977	N	8	16	39	63	8	13	42	63	4	13	46	63
STATE OF DOCTORATE - TOTAL, 12 WICHE STATES													
1967	N	1196	570	2253	4019	925	590	2504	4019	638	555	2826	4019
1972	N	1915	1094	3569	6578	1516	1092	3970	6578	1046	965	4567	6578
1977	N	1942	968	3428	6338	1474	954	3910	6338	1032	809	4497	6338

APPENDIX B

THE NINE CENSUS REGIONS OF THE UNITED STATES



States in Each Region:

1. New England: Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut
2. Middle Atlantic: New York, New Jersey, Pennsylvania
3. East North Central: Ohio, Indiana, Illinois, Michigan, Wisconsin
4. West North Central: Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas
5. South Atlantic: Delaware, Maryland, D.C., Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida
6. East South Central: Kentucky, Tennessee, Alabama, Mississippi
7. West South Central: Arkansas, Louisiana, Oklahoma, Texas
8. Mountain: Montana, Wyoming, Colorado, New Mexico, Arizona, Utah
9. Pacific: Washington, Oregon, California, Alaska, Hawaii (plus Puerto Rico and Panama Canal Zone)

1970 Population by Census Region (in thousands)

New England	11,842	East South Central	12,803
Middle Atlantic	37,199	West South Central	19,321
East North Central	40,252	Mountain	8,282
West North Central	16,319	Pacific	26,523
South Atlantic	30,671	TOTAL U.S.	203,212

SOURCE: NRC, Commission on Human Resources

REGIONAL INTERCHANGES BETWEEN HIGH SCHOOL GRADUATION AND DOCTORATE DEGREE, PhD's OF 1960-1974, BOTH SEXES COMBINED

Region of High School		Region of PhD: New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific and Insular	Total
NEW ENGLAND	N*	9702	3977	3098	707	1868	218	371	317	1656	19914
	V	22.1	6.3	3.9	2.3	2.1	2.1	1.9	2.8	8.7	4.9
	H	39.1	20.8	16.2	3.7	4.8	1.1	1.9	1.6	8.3	100.0
MIDDLE ATLANTIC	N	7267	31113	11053	2304	6681	778	1297	1535	4695	66625
	V	16.6	49.7	13.8	7.5	18.3	7.5	6.5	8.5	19.1	16.6
	H	10.9	46.7	16.6	3.5	10.0	1.2	1.9	2.3	7.0	100.0
EAST NORTH CENTRAL	N	2922	4325	30685	4229	3617	830	1512	2366	4627	54913
	V	6.6	6.9	38.6	13.8	9.9	7.7	6.6	13.0	18.9	13.6
	H	5.3	7.9	55.9	7.7	6.6	1.5	2.8	4.3	8.4	100.0
WEST NORTH CENTRAL	N	1140	1725	5645	11737	1451	459	1757	2473	2824	29201
	V	2.6	2.8	7.1	38.3	4.0	4.3	7.5	13.6	11.5	8.7
	H	3.9	5.9	19.3	40.2	5.0	1.6	6.0	8.5	9.7	100.0
SOUTH ATLANTIC	N	1701	3027	3940	824	11966	1570	1126	556	1496	26186
	V	3.8	4.8	5.0	2.7	32.8	14.6	4.8	3.1	6.2	7.8
	H	6.5	11.6	15.0	3.1	45.6	6.0	4.3	2.1	5.7	100.0
EAST SOUTH CENTRAL	N	425	663	2140	497	2186	4445	1207	279	320	12359
	V	1.4	1.1	2.7	1.6	6.0	41.2	4.6	1.6	1.3	3.7
	H	3.4	5.4	17.3	4.0	17.7	36.0	9.8	2.3	2.6	100.0
WEST SOUTH CENTRAL	N	673	893	2461	1374	1596	1030	11845	1110	1412	22162
	V	2.2	1.5	3.1	4.5	4.4	9.6	45.2	6.4	5.6	6.6
	H	3.0	4.0	11.1	6.2	7.2	4.6	52.5	5.1	6.4	100.0
MOUNTAIN	N	517	770	1914	977	560	129	603	4771	2606	12937
	V	1.8	1.3	1.7	3.4	1.9	1.2	2.9	26.8	10.8	3.8
	H	4.0	6.0	14.8	7.6	4.3	1.0	4.7	36.9	20.2	100.0
PACIFIC AND INSULAR	N	1578	2084	3633	1185	1105	196	681	2171	15670	28103
	V	3.2	3.4	3.3	4.1	3.8	1.9	2.4	12.2	65.0	8.4
	H	5.6	7.4	12.9	4.2	3.9	.7	2.4	7.7	55.8	100.0
FOREIGN	N	5051	10603	13346	4646	4911	948	2953	2063	9218	53737
	V	11.5	16.9	16.9	16.2	13.9	8.8	12.0	11.6	38.2	16.0
	H	9.4	19.7	24.8	8.6	9.1	1.8	5.5	3.8	17.2	100.0
UNKNOWN	N	1536	3721	1425	266	786	156	333	329	1757	10307
	V	3.2	5.9	1.8	.9	2.2	1.5	1.2	1.8	7.3	3.1
	H	14.9	36.1	13.8	2.6	7.6	1.5	3.2	3.2	17.0	100.0
TOTAL	N	43910	62905	79146	28874	36665	10758	23485	18170	49571	353484
	V	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
	H	8.8	18.7	23.6	8.5	10.9	3.2	7.0	5.4	13.9	100.0

SOURCE: NRC, Commission on Human Resources

*N = number of persons; V = vertical percent; H = horizontal percent.

APPENDIX D

REGIONAL INTERCHANGES AFTER THE DOCTORATE: PERCENTAGE DISTRIBUTIONS, BY REGION OF DESTINATION, FOR PhD's OF 1960-1974 SEEKING TRAINING AND EMPLOYMENT IN ACADEME OR ELSEWHERE

Region of PhD	Region of Post-PhD Destination											
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific	U.S. Total	Foreign	Unknown
New England												
Postdoctoral study	34.4	10.8	5.7	1.6	7.2	0.5	1.3	1.9	11.3	74.7	16.8	8.5
Academic employment	36.7	14.3	9.7	2.9	6.7	1.4	2.0	1.7	7.5	83.0	5.5	11.5
Nonacademic employment	27.7	14.4	3.7	1.1	8.9	0.6	1.5	1.5	5.1	64.4	13.6	22.0
Middle Atlantic												
Postdoctoral study	8.1	39.5	7.7	1.6	7.0	0.8	1.6	1.6	8.2	76.2	13.4	10.5
Academic employment	6.8	45.8	8.9	2.4	7.5	1.6	2.0	1.5	5.2	81.8	5.5	12.7
Nonacademic employment	4.2	49.9	3.8	0.7	7.5	0.6	1.1	1.0	3.4	72.1	10.4	17.5
East North Central												
Postdoctoral study	6.9	9.8	34.6	3.4	7.4	1.3	2.3	2.3	10.3	78.3	12.9	8.9
Academic employment	3.9	8.6	37.2	6.5	8.3	3.6	3.8	3.3	6.8	82.4	5.4	12.3
Nonacademic employment	2.3	9.9	33.9	2.5	8.1	1.4	2.2	1.8	5.4	67.4	13.1	19.4
West North Central												
Postdoctoral study	5.1	9.3	12.4	28.0	7.9	2.0	3.2	2.7	8.9	79.5	10.2	10.3
Academic employment	2.4	4.9	16.4	33.8	6.1	3.3	5.5	4.6	6.0	82.9	4.5	12.6
Nonacademic employment	1.4	6.2	10.2	29.0	6.8	1.4	4.1	2.4	4.9	66.3	12.3	21.5
South Atlantic												
Postdoctoral study	6.4	9.3	7.6	2.9	37.6	2.6	3.6	2.1	7.0	79.2	9.9	10.8
Academic employment	3.1	7.8	7.5	3.1	45.0	7.4	4.7	1.6	3.5	83.7	3.7	12.6
Nonacademic employment	2.0	7.8	3.7	1.1	49.3	2.6	2.4	1.0	2.6	72.5	8.3	19.2
East South Central												
Postdoctoral study	3.9	7.2	7.8	4.8	14.2	30.7	6.1	2.3	6.2	83.1	7.3	9.6
Academic employment	0.9	2.1	6.3	3.4	18.0	41.6	10.0	1.1	1.6	85.0	2.0	13.0
Nonacademic employment	0.8	4.5	4.8	1.8	17.4	39.1	5.6	1.0	1.8	76.8	5.1	18.1
West South Central												
Postdoctoral study	4.6	7.1	8.0	3.3	7.5	2.1	34.7	2.1	7.0	76.3	9.0	14.7
Academic employment	1.1	2.7	6.2	7.3	7.5	6.8	43.6	3.2	4.0	82.3	2.9	14.8
Nonacademic employment	0.8	3.0	3.0	3.3	6.0	3.1	43.7	2.6	3.8	69.5	7.9	22.6
Mountain												
Postdoctoral study	4.9	8.1	9.5	4.1	8.0	1.1	3.7	34.6	11.5	75.4	10.8	13.8
Academic employment	1.6	3.5	9.5	10.3	4.4	2.1	6.1	39.1	12.3	78.8	4.3	16.9
Nonacademic employment	0.9	3.8	4.7	4.2	4.4	0.7	3.7	34.7	12.5	69.6	7.6	22.8
Pacific												
Postdoctoral study	7.0	8.2	6.8	2.0	5.5	0.5	1.7	2.4	40.2	74.4	16.4	9.2
Academic employment	3.9	6.4	8.6	4.0	4.1	1.1	2.8	6.5	43.8	81.3	7.2	11.5
Nonacademic employment	1.4	5.5	2.6	1.0	4.7	0.4	1.2	2.5	47.7	67.0	15.0	18.0
Total												
Postdoctoral study	9.6	14.6	13.6	4.5	10.5	2.0	4.2	3.0	14.8	76.9	13.0	10.1
Academic employment	6.6	13.9	16.4	7.6	11.3	4.7	6.9	4.5	10.7	82.3	5.0	12.7
Nonacademic employment	4.2	16.1	11.0	4.0	12.0	2.4	4.9	3.8	10.7	69.1	11.3	19.6

SOURCE: NRC, Commission on Human Resources.

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